

# Speech Recognition Middleware Programming Manual

## CTR Programming Guide

Version 1.0.2

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# 1 Introduction

## 1.1 Overview of Speech Recognition

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This document summarizes the features, use, and usage notes for the Speech Recognition library. To develop applications that satisfy the user, it helps to understand the special characteristics of speech recognition. For details of the features and API functions, see the Function Reference Manual (the associated HTML files).

## 1.2 Capabilities of Speech Recognition

---

The following explains what applications can and cannot do by using speech recognition.

Applications can:

- Recognize registered words  
Words (or phrases) must be registered as text in a lexicon in advance. The speech recognition engine then evaluates which of these words the user said. In addition, the registered words can be changed each time the user says something, so it is possible to swap to different recognition words for different game scenes.
- Recognize speech from unidentified speakers  
Users do not need to register their voices ahead of time. They can begin to use speech recognition immediately.
- Recognize in real-time  
The speech recognition engine automatically evaluates the start and end of speech and returns recognition results simultaneously with the detection of the end of speech.
- Use recognition scores  
Although recognition scores cannot be used as absolute evaluative scores, if the difference between the number-one and number-two candidates is large, the speech recognition engine can evaluate which of them is more likely correct.

Applications cannot:

- Recognize unregistered words  
Words or phrases that have not been registered in the lexicon cannot be recognized.
- Obtain 100% recognition  
Recognition results can change depending on ambient noise and the condition of the speaker. See Chapter 4 Tips and Techniques for Better Speech Recognition for tips on using application-side prompts to improve recognition accuracy.

Examples of Use in Applications

- Verbally call to or give instructions to an in-game character.  
Example: Speech recognition is not limited to predetermined names; the user is able to name

characters and call to them by those names.

- Jump straight to a command in a hierarchical menu.

Example: Instead of selecting Menu → Fight → Slam using menus and sub-menus, the user can simply say "Slam!"

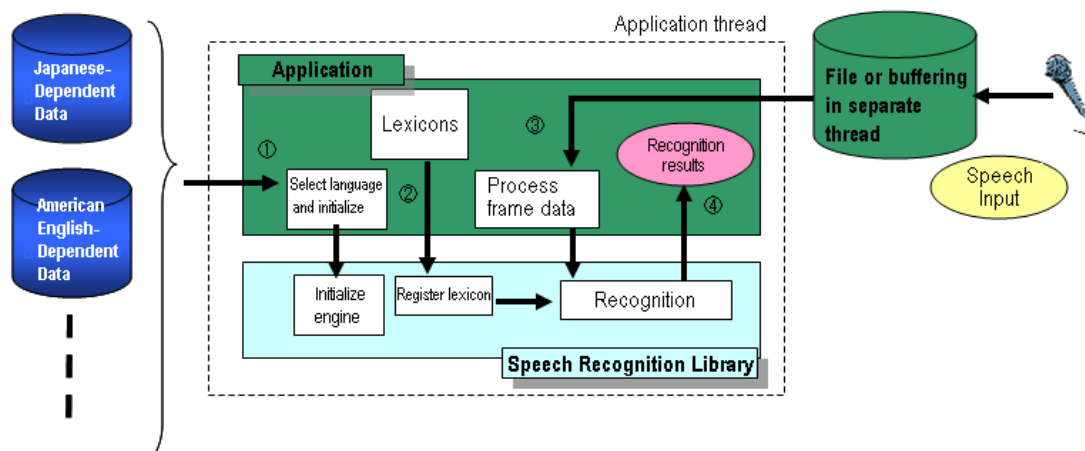
- Practice pronunciation of English or other foreign languages.
- Input in situations where the spoken words are predefined, such as answers to multiple-choice quizzes.

Applications cannot use speech recognition to replace all input from the buttons and/or touch panel. Use the capabilities of each individual input device to supplement the capabilities of other input devices.

## 2 How to Use the Speech Recognition Middleware

### 2.1 Overview of Software Configuration and Operation

Figure 2-1 Software Configuration



The speech recognition software module consists of the speech recognition core engine and language-dependent data. It is provided as a library linked by the application and a set of binary data files placed in ROM. Because this library is not a reentrant library, it cannot be used simultaneously by multiple applications or multiple threads.

### 2.2 Procedure for Creating Applications

The application must include the `asr.h` header file and link the `libmw_asr.*.a` library file.

The language-dependent data required to switch languages is provided as sets of the following six binary files, with one set per language.

Table 2-1 Language-Dependent Data

| Category | Description                                                                                                                                                                                                                                                                                                                 |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| dtb.bin  | <b>Set of Language-Dependent Data</b><br>Divided into 5 sub-files for ease of performance updates.<br>The application must load the data into the prescribed structure in RAM and then pass it to the recognition engine.                                                                                                   |
| hmm.bin  |                                                                                                                                                                                                                                                                                                                             |
| phn.bin  |                                                                                                                                                                                                                                                                                                                             |
| tree.bin |                                                                                                                                                                                                                                                                                                                             |
| mdc.bin  |                                                                                                                                                                                                                                                                                                                             |
| str.bin  | <b>Initial Environmental History Data</b><br>History data required to compensate for variance between individual hardware systems. This data is updated within the engine each time recognition is performed. You can get the updated data with the engine finalization function. The application uses the initial data the |

| Category | Description                                                                                                                                                                                                                                |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | first time it starts up speech recognition; every time thereafter it is able to tune the recognition to the variances of the individual hardware systems by passing the data returned by the engine to the engine initialization function. |

Select your necessary language-dependent data and then place the six binary data files in the ROM image by listing them in the ROM spec file. When speech recognition begins, the application must use the ROM file system API to load this data into RAM, set these values in the prescribed structure, and call the function that sets the language. (For details of the process, see Chapter 3 Using the API.)

```
# Example Additions to the ROM Spec File (.rsf)
```

```
Rom:
```

```
HostRoot : $(CTRMW_ASR_ROOT)/resources
```

HostRoot and Root vary depending on the location of the binary data during application development and the file access path within the application.

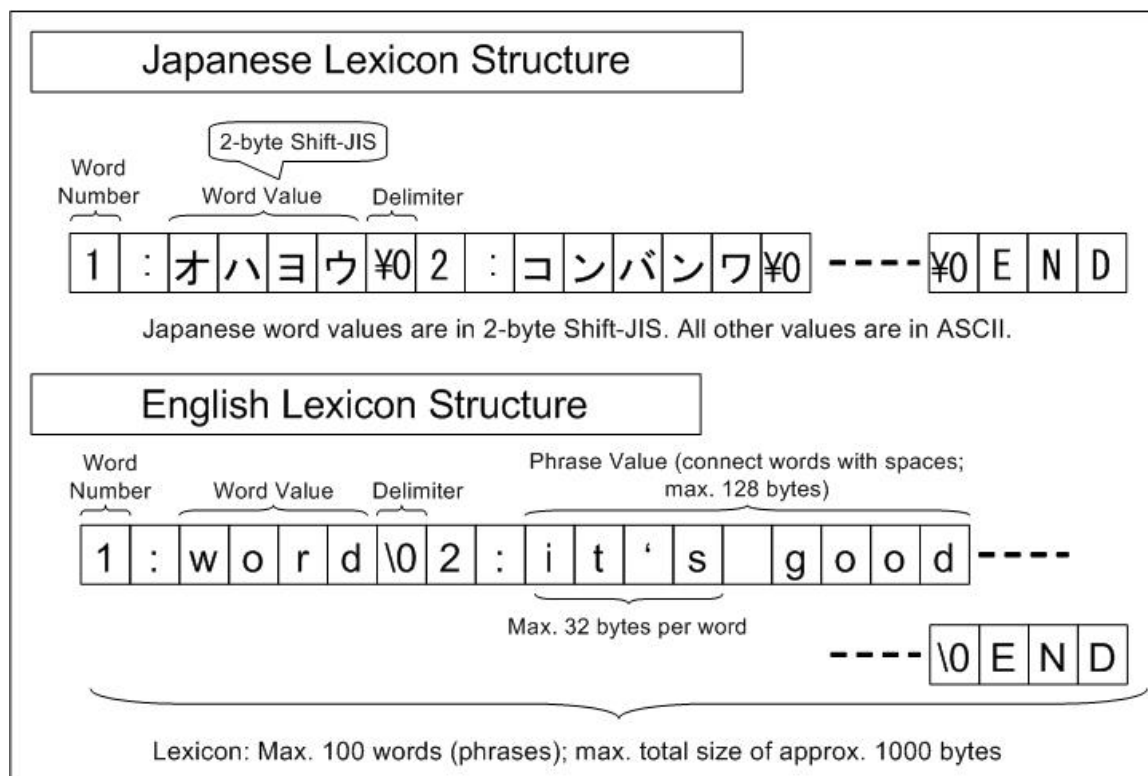
The values contained in the `str.bin` data file are updated within the recognition engine and returned by the recognition engine finalization function. Use this updated data whenever possible when calling the engine initialization function.

Depending on purpose, sometimes multiple different versions of the library and the language-dependent data are prepared.

## 2.3 Recognition Lexicons

Before you use speech recognition, the words or phrases to be recognized must be registered in a recognition lexicon. Recognition lexicons are text-based, so their content can be freely changed within the application.



**Figure 2-2 Recognition Lexicon Structure**

Each word in the lexicon consists of [the word number] + ":" + [the word notation itself] + [a delimiter (NULL)]. As many as 100 words can be strung together. The notation for the end of the recognition lexicon is "END".

For European languages, it is possible to register phrases consisting of multiple sequential words by separating each word with a space (0x20), tab (0x09), or underscore (0x5f).

If sequential words are separated by a hyphen (0x2d), the engine parses it as words pronounced sequentially in compliance with the pronunciation rules. Recognition results when words are delimited with hyphens therefore differ from cases where words are delimited with spaces or the equivalent characters. However, if a word with nonstandard normal pronunciation is delimited by hyphens, the result does not match the word's normal pronunciation. The following table shows how the registered pronunciations can differ depending on their delimiters.

**Table 2-2 Examples of Differing Registered Pronunciations**

| Notation                 | Registered Pronunciation (Phonetic Transcription) |
|--------------------------|---------------------------------------------------|
| capable                  | kéipəbl (registered as nonstandard pronunciation) |
| "cap able" or "cap_able" | kæpéibl (two separate sequential words)           |
| cap-able                 | kæpabl (generated from the pronunciation rules)   |

If a European language is specified, the Speech Recognition library allows you to use phonetic transcription to register words in the recognition lexicon.

In phonetic notation, each word consists of [the word number] + ":" + "#" + [the phonetic word notation itself] + [a delimiter (NULL)]. As many as 100 words can be strung together. The phonetic notation available for registering words differs depending on the language. (For an example of this notation and a list of phonetic transcriptions for each language, see section A.1 Phonetic Notations.)

Because you can use both the word notation format and phonetic notation formats in parallel, it is possible to phonetically register words in sub-lexicons for regionally different pronunciations of words and for special pronunciations, for example of character names.

For details of the specifications and restrictions of recognition lexicons, see the Function Reference Manual.

## 3 Using the API

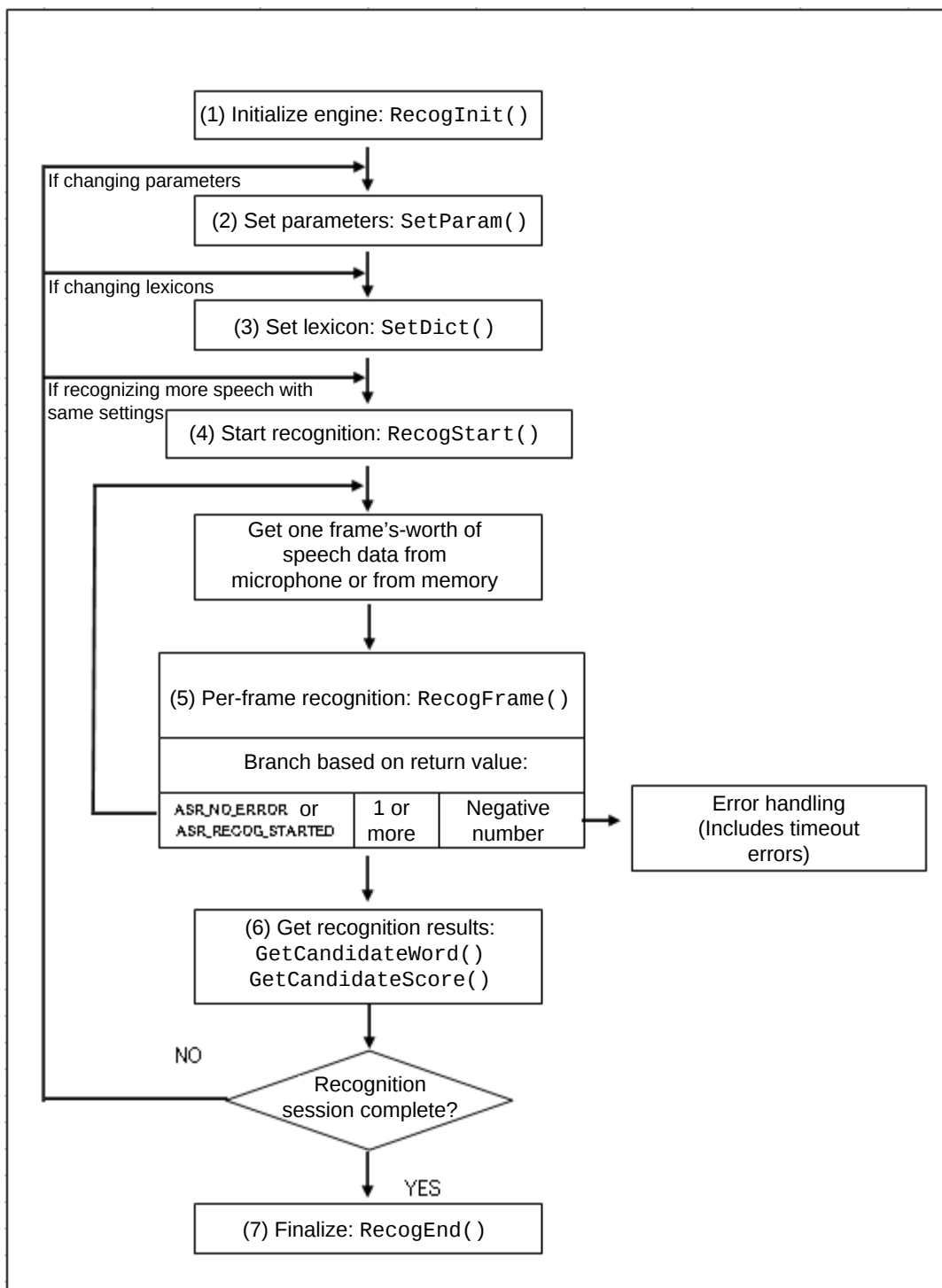
This chapter describes the procedure for using the Speech Recognition API. Use this procedure in situations where the application controls the microphone or recognizes prerecorded audio data. For detailed specifications of the various functions, see the Function Reference Manual.

### 3.1 Using the API

---

Use this API in situations such as where the application itself controls the hardware microphone and performs audio sampling, where the application recognizes audio data already stored in memory, or where there is a need to fine-tune the priority of the recognition thread. Speech recognition processing runs on a per-frame basis (frames are variable-length but are at least 128 points), so the application must divide the audio data into frames and call the API per each frame.

Figure 3-1 API Processing Flow



When using these API functions, the application must pass one frame of audio data to the `RecogFrame` function and evaluate, based on its return value, whether to continue recognition or end recognition.

The `RecogFrame` function returns `ASR_NO_ERROR` until there is valid audio input, and thereafter returns `ASR_RECOG_STARTED` until speech recognition finishes.

Passing of the pointer to the audio data, and the recognition process, are shown in the following example. (Error handling is omitted.)

#### Code A-1 Example Implementation (Recognizing Japanese)

```
#define FRAME_SIZE 183 /* Data size equivalent to 1 frame (16.7 ms) */
unsigned char *dicList[] = {"アカ", "アオ", "ミドリ", "キイロ", "ムラサキ"};
/* The 'addr' pointer points to 'size' words-worth of recorded audio data */
void VoiceRecog(short *addr, short size)
{
    short i, ret, *pv;
    mw::asr::ParamType param;
    mw::asr::DataItemType item[ASR_DATA_ITEM_NUM] ;
    short *workMem; /* Recognition engine's working memory */
    unsigned char *p, dict[128] ;
    /* ① Initialize recognition engine */
    /* item[] : Language-dependent data setting (Omitted) */
    /* workMem: Working memory allocation (Omitted: both static and dynamic are
    possible) */
    ret = mw::asr::RecogInit(LANG_JAPANESE, item, ASR_DATA_ITEM_NUM, workMem);
    /* ② Set parameters */
    param.maxCandidate = 3; /* Return top 3 recognition candidates */
    param.offTimeout = 4000; /* Timeout if silence for 4 seconds */
    param.onTimeout = 4000; /* Timeout if speech continues for 4 seconds */
    param.epdInterval = 300; /* Set end-of-speech detection interval to 300 ms
    */
    ret = mw::asr::SetParam(&param);

    /* ③ Create and configure recognition lexicon */
    p = dict ;
    for (i = 0 ; i < 5; i++) {
        /* Format is "<Number>:"+"<Word>"+'\0' ... +"END" */
        p += sprintf(p, "%d:%s", i+1, dicList[i]) + 1;
    }
    sprintf(p, "END");
    ret = mw::asr::SetDict(dict, 5);
    /* ④ Start recognition */
    ret = mw::asr::RecogStart();
    /* ⑤ Run recognition per frame */
    pv = addr;
    while (ret == ASR_NO_ERROR || ret == ASR_RECOG_STARTED) {
```

```

        ret = mw::asr::RecogFrame(pv, FRAME_SIZE);
pv += FRAME_SIZE;
if (pv + FRAME_SIZE > addr + size) break;
    }
    /* ⑥ Processing in response to recognition results */
    if (ret <= 0) { /* Error handling */ };
if (ret > 0) {
    /* This outputs to the debugger console */
    for (i = 0; i < ret; i++) {
        short num = mw::asr::GetCandidateWord(i+1);
        short score = mw::asr::GetCandidateScore(i+1);
        NN_LOG("%d: %s \t %d\n", i+1, dicList[num-1], score);
    }
}
/* ⑦ Finalization */
ret = mw::asr::RecogEnd(strData);
}

```

## 3.2 Setting the Language-Dependent Data

Language-dependent data is provided as sets of six binary data files. Use the RSF file to place this data in ROM, then load it into memory using the ROM file system API. You can also place it within the program as const data.

## 3.3 Notes and Cautions

- Simultaneous use of multiple engines  
Do not use multiple engines simultaneously. This recognition engine is not reentrant. Link only a single library to a single application, and use it in only one thread.
- Indices when getting recognition results  
The recognition candidates passed to the function that gets recognition results are ranked starting from 1.
- Entering Sleep Mode  
If the recognition engine is in use, the application must perform the following processing before entering Sleep Mode.
  - If the RecogFrame function is in use, do not enter Sleep Mode until that function has ended and the RecogEnd function has been called. (The RecogFrame function will immediately prepare recognition results if you input a frame of size 0, so you can also get the recognition results before entering Sleep Mode.) The same goes for all other situations where a recognition engine function is in use: do not enter Sleep Mode until the RecogEnd function has been called.

- Finalizing the recognition engine  
Never finalize the recognition engine until after recognition has completed.

## 4 Tips and Techniques for Better Speech Recognition

### 4.1 Improving Recognition Accuracy

Recognition Words Tip 1: Register distinct words

- Avoid using words with similar pronunciations, such as "Mario" and "Wario," at the same time.
- Recognition accuracy is better for long words than for short ones.
- The fewer words you register, the better the recognition accuracy is.

Recognition Words Tip 2: Categorize (register sub-lexicons)

- Register many words with the same meaning so that you get the desired result if any one of them is recognized.

Example: Register words to your lexicon as shown below, and evaluate the speech's meaning by the first digit of the recognized word's number. (In the example below some spaces are NULL characters.)

```
11:one 12:first 13:first piece 14:the first 21:two 22:second 23:second piece 24:the
second 31:three 32:third 33:third piece 34:the third 41:yellow 42:ellow 43:yello
END
```

Recognition Words Tip 3: Don't register words "as written," register them "as spoken"

- Register the sound that is actually uttered when the word is spoken. If a word can be pronounced several different ways, you can improve its recognition accuracy by registering it in a "sub-lexicon" as shown in the example above.

**Table 4-1 Registering Words with Multiple Pronunciations**

| Word to Register | Example Lexicon Entries |
|------------------|-------------------------|
| 東京               | トーキョー、トウキョー             |
| 大阪               | オーサカ                    |
| 経営               | ケーエー、ケイエー               |
| こんにちは            | コンニチワ (Not "コンニチハ")     |
| 学校へ              | ガッコーエ (Not "ガッコウへ")     |
| 私を               | ワタシオ                    |
| 多い               | オーイ                     |



| Word to Register | Example Lexicon Entries |
|------------------|-------------------------|
| 氷                | コーリ                     |
| 全員               | ゼンイン、ゼーイン               |

- When using recognition with English or other European languages, proper nouns imported from other languages (such as place names or person names) sometimes cannot be recognized because they have different pronunciation rules than the surrounding language.

### User Interface Tips

- Recognition accuracy is greatly affected by the timing of speech and the surrounding environment. When the recognition engine starts running, give the user some GUI-based prompt to speak; and either lower the volume of background music or, if possible, mute it entirely while recognition is in progress.
- Guide users in some way so that users easily understand what to say (which words are available). It is best to ask simple questions whose possible answers are circumscribed, such as "What color is this flower?" or "How many flowers are there?" or something like "Cast which spell?" and display the possible spells.
- When the speech recognition engine has to choose between many possible words in the lexicon and the lexicon contains some words with similar pronunciations, the probability of the first recognition candidate being correct decreases. In situations where a word-recognition mistake would cause problems, implement some sort of user confirmation such as displaying a list of the five top recognition candidates and letting the user choose the correct one.

### Explain the characteristics of speech input and how to use it

- If your game uses speech recognition, give a simple explanation of speech input in the Instruction Booklet.  
Example: "In a place with no loud background noise, speak in a normal voice with your mouth no closer than 2 cm and no farther than 30 cm from the system." Speech recognition becomes more difficult if the user shouts or speaks very slowly and clips the syllables of words apart.
- Let users know that **speech recognition accuracy is not 100%** and prepare them for error recovery.

## 5 Q&A

Q: When speech recognition does not accept my input in my native language, what should I do?

A: Verify that you are not starting to speak too soon. Also, see section 4.1 Improving Recognition Accuracy and check that you have the right terms registered in your lexicon.

Q: When speech recognition does not accept my input in a foreign language, what should I do?

A: The speech recognition engine is tuned to native-speaker pronunciation of the supported languages and might not be able to recognize the speech of foreign speakers very well. Even advanced speakers of foreign languages sometimes have trouble being recognized if they have non-native pronunciation.

Q: Can I recognize an entire sentence?

A: Yes, you can register a whole sentence as a phrase in the lexicon, but the length is limited. (The limit is 128 characters for Western languages or 64 characters for Japanese.)

Q: Can the system recognize different regional accents and dialects?

A: If the difference in patterns is limited to stress and intonation, the recognition system is able to handle a certain amount of variance. If there are actual pronunciation differences where the word would require a different phonetic notation to be written accurately, some errors might occur.

Q: How do I use recognition scores?

A: Recognition scores vary depending on the speaker and the surroundings, so they cannot be used as absolute values. However, the difference in scores between the first and second recognition candidates allows you to evaluate the reliability of the first candidate. Likewise, the scores can be used for relative comparison, such as telling the user they have improved when doing foreign language pronunciation drills.

Q: Is there any way to recognize from among more than 100 words at the same time?

A: You can't recognize from among more than 100 words at the same time. However, the application can freely switch between recognition lexicons, so if you prepare a hierarchy of lexicons and run speech recognition several times, you can make it possible for the user to verbally indicate what they need from among more than 100 words.

# Appendix A

## A.1 Phonetic Notations

The Speech Recognition library allows you to register words in lexicons using a subset of the SAMPA<sup>1</sup> phonetic alphabet. You can only register words using the phonetic notation corresponding to the language(s) configured on initialization of the recognition engine. Using any other notation to register words results in an error. Table 5-1 and subsequent tables show the phonetic notation available to register words in the various languages.

Examples of recognition lexicons you can register words to with the `SetDict` function are shown below. **Strings in phonetic notation are prefixed with "#".**

### Code A-1 Example of Registering “1:hello 2:world END” in Only Phonetic Notation

- If `LANG_US_ENGLISH` is specified:

```
"1:#hEl@ 1:#h@l@ 2:#w3`ld END"
```

- If `LANG_BRITISH` is specified:

```
"1:#h@l@U 1:#he1@U 2:#w3:ld END"
```

As shown above, "#h@l@" is British English pronunciation and "#he1@u" is American English pronunciation. You can also use sub-lexicons (categories of words with the same meaning but different pronunciations) to register both pronunciations, as shown in the following example.

### Code A-2 Example of Parallel Normal and Phonetic Notation of Words (with `LANG_US_ENGLISH` Specified)

```
"1:hello 1:#hEl@ 1:#h@l@ 2:world 2:#w3`ld END"
```

Normal notation and phonetic notation both give the same results in this example, but in cases of words whose spelling and pronunciation diverge from the general pronunciation rules (such as game character names) or words that might be given nonstandard pronunciation due to regional accents or other reasons, you can improve recognition accuracy by registering both the normal and phonetic notations of the words in the lexicon.

- When registering phrases of multiple words  
When you use spaces to string together multiple words and register a phrase, all words in phonetic notation must be prefixed with "#". You can mix together normal and phonetic notation for words in the same phrase.

### Code A-3 Example of Mixed Normal and Phonetic Notation in the Same Phrase

```
"1:#hEl@ #w3`ld 2:hello #w3`ld END"
```

In this example, word number 1 and word number 2 are both parsed the same way.

<sup>1</sup> Speech Assessment Methods Phonetic Alphabet: A computer-displayable phonetic script using only 7-bit ASCII characters, based on the International Phonetic Alphabet (IPA).

### A.1.1 US\_English

**Table 5-1 Consonants: US\_English**

| Symbol    | Word    | Transcription |
|-----------|---------|---------------|
| <b>p</b>  | pin     | pIn           |
| <b>b</b>  | bin     | bIn           |
| <b>t</b>  | tin     | tIn           |
| <b>d</b>  | din     | dIn           |
| <b>k</b>  | kin     | kIn           |
| <b>g</b>  | give    | gIV           |
| <b>tS</b> | chin    | tSIn          |
| <b>dZ</b> | gin     | dZIn          |
| <b>f</b>  | fin     | fIn           |
| <b>v</b>  | vim     | vIm           |
| <b>T</b>  | thin    | TIn           |
| <b>D</b>  | this    | DIs           |
| <b>s</b>  | sin     | sIn           |
| <b>z</b>  | zing    | zIN           |
| <b>S</b>  | shin    | SIn           |
| <b>Z</b>  | measure | mEZ3`         |
| <b>h</b>  | hit     | hIt           |
| <b>m</b>  | mock    | mAk           |
| <b>n</b>  | knock   | nAk           |
| <b>N</b>  | thing   | TIN           |
| <b>r</b>  | wrong   | rON           |
| <b>l</b>  | long    | lON           |
| <b>w</b>  | wasp    | wAsp          |
| <b>j</b>  | yacht   | jAt           |

**Table 5-2 Vowels: US\_English**

| Symbol   | Word | Transcription |
|----------|------|---------------|
| <b>I</b> | pit  | pIt           |
| <b>E</b> | pet  | pEt           |
| <b>{</b> | pat  | p{t           |
| <b>A</b> | pot  | pAt           |
| <b>V</b> | cut  | kVt           |
| <b>U</b> | put  | pUt           |
| <b>i</b> | ease | iz            |

| Symbol | Word  | Transcription |
|--------|-------|---------------|
| e      | raise | rez           |
| u      | lose  | luz           |
| o      | nose  | noz           |
| 0      | cause | k0z           |
| aI     | rise  | raIz          |
| 0I     | noise | n0Iz          |
| aU     | rouse | raUz          |
| 3`     | furs  | f3`z          |
| @      | allow | @laU          |

## A.1.2 British English

Table 5-3 Consonants: British

| Symbol | Word    | Transcription |
|--------|---------|---------------|
| p      | pin     | pIn           |
| b      | bin     | bIn           |
| t      | tin     | tIn           |
| d      | din     | dIn           |
| k      | kin     | kIn           |
| g      | give    | gIV           |
| tS     | chin    | tSIn          |
| dZ     | gin     | dZIn          |
| f      | fin     | fIn           |
| v      | vim     | vIm           |
| T      | thin    | TIn           |
| D      | this    | DIIs          |
| s      | sin     | sIn           |
| z      | zing    | zIN           |
| S      | shin    | SIn           |
| Z      | measure | mEZ@          |
| h      | hit     | hIt           |
| m      | mock    | mQk           |
| n      | knock   | nQk           |
| N      | thing   | TIN           |
| r      | wrong   | rQN           |
| l      | long    | lQN           |
| w      | wasp    | wQsp          |
| j      | yacht   | jQt           |

**Table 5-4 Vowels: British**

| Symbol    | Word    | Transcription |
|-----------|---------|---------------|
| <b>I</b>  | pit     | pIt           |
| <b>e</b>  | pet     | pet           |
| <b>{</b>  | pat     | p{t           |
| <b>Q</b>  | pot     | pQt           |
| <b>v</b>  | cut     | kVt           |
| <b>U</b>  | put     | pUt           |
| <b>@</b>  | another | @nVD@         |
| <b>i:</b> | ease    | i:z           |
| <b>eI</b> | raise   | reIz          |
| <b>aI</b> | rise    | raIz          |
| <b>OI</b> | noise   | nOIz          |
| <b>u:</b> | lose    | lu:z          |
| <b>@U</b> | nose    | n@Uz          |
| <b>aU</b> | rouse   | raUz          |
| <b>3:</b> | furs    | f3:z          |
| <b>A:</b> | stars   | stA:z         |
| <b>O:</b> | cause   | kO:z          |
| <b>I@</b> | fears   | fI@z          |
| <b>U@</b> | cures   | kjU@z         |

### A.1.3 French

**Table 5-5 Consonants: French**

| Symbol   | Word  | Transcription |
|----------|-------|---------------|
| <b>p</b> | pont  | po~           |
| <b>b</b> | bon   | bo~           |
| <b>t</b> | temps | ta~           |
| <b>d</b> | dans  | da~           |
| <b>k</b> | quand | ka~           |
| <b>g</b> | gant  | ga~           |
| <b>f</b> | femme | fam           |
| <b>v</b> | vent  | va~           |
| <b>s</b> | sans  | sa~           |
| <b>z</b> | zone  | zon           |
| <b>S</b> | champ | Sa~           |

| Symbol   | Word   | Transcription |
|----------|--------|---------------|
| <b>Z</b> | gens   | Za~           |
| <b>m</b> | mont   | mo~           |
| <b>n</b> | nom    | no~           |
| <b>J</b> | oignon | oJo~          |
| <b>l</b> | long   | lo~           |
| <b>R</b> | rond   | Ro~           |
| <b>w</b> | coin   | kwe~          |
| <b>H</b> | juin   | ZHe~          |
| <b>j</b> | pierre | pjER          |

Table 5-6 Vowels: French

| Symbol    | Word      | Transcription |
|-----------|-----------|---------------|
| <b>i</b>  | si        | si            |
| <b>e</b>  | ses       | se            |
| <b>E</b>  | seize     | sEz           |
| <b>a</b>  | patte     | pat           |
| <b>O</b>  | comme     | kOm           |
| <b>o</b>  | gros      | gRo           |
| <b>u</b>  | doux      | du            |
| <b>y</b>  | du        | dy            |
| <b>9</b>  | neuf      | n9f           |
| <b>@</b>  | justement | Zyst@ma~      |
| <b>e~</b> | vin       | ve~           |
| <b>a~</b> | vent      | va~           |
| <b>o~</b> | bon       | bo~           |

## A.1.4 Spanish

Table 5-7 Consonants: Spanish

| Symbol    | Word  | Transcription |
|-----------|-------|---------------|
| <b>p</b>  | padre | padre         |
| <b>b</b>  | vino  | bino          |
| <b>t</b>  | tomo  | tomo          |
| <b>d</b>  | donde | donde         |
| <b>k</b>  | casa  | kasa          |
| <b>g</b>  | gata  | gata          |
| <b>tS</b> | mucho | mutSo         |

| Symbol    | Word  | Transcription |
|-----------|-------|---------------|
| <b>f</b>  | fácil | faTil         |
| <b>T</b>  | cinco | Tinko         |
| <b>s</b>  | sala  | sala          |
| <b>x</b>  | mujer | muxer         |
| <b>m</b>  | mismo | mismo         |
| <b>n</b>  | nunca | nunka         |
| <b>J</b>  | año   | aJo           |
| <b>l</b>  | lejos | lexos         |
| <b>r</b>  | puro  | puro          |
| <b>rr</b> | torre | torre         |

Table 5-8 Vowels: Spanish

| Symbol   | Word  | Transcription |
|----------|-------|---------------|
| <b>j</b> | rei   | rrej          |
| <b>i</b> | pico  | piko          |
| <b>e</b> | pero  | pero          |
| <b>a</b> | valle | baje          |
| <b>o</b> | toro  | toro          |
| <b>u</b> | duro  | duro          |

## A.1.5 German

Table 5-9 Consonants: German

| Symbol    | Word      | Transcription |
|-----------|-----------|---------------|
| <b>p</b>  | Pein      | paIn          |
| <b>b</b>  | Bein      | baIn          |
| <b>t</b>  | Teich     | taIx          |
| <b>d</b>  | Deich     | daIx          |
| <b>k</b>  | Kunst     | kUnst         |
| <b>g</b>  | Gunst     | gUnst         |
| <b>pf</b> | Pfahl     | pfa:l         |
| <b>ts</b> | Zahl      | tSa:l         |
| <b>tS</b> | deutsch   | dOYtS         |
| <b>dZ</b> | Dschungel | dZUNg@l       |
| <b>f</b>  | fast      | fast          |
| <b>v</b>  | was       | vas           |
| <b>s</b>  | Tasse     | tas@          |



| Symbol   | Word    | Transcription |
|----------|---------|---------------|
| <b>z</b> | Hase    | ha:z@         |
| <b>S</b> | waschen | vaS@n         |
| <b>Z</b> | Genie   | Zeni:         |
| <b>j</b> | Jahr    | ja:R          |
| <b>x</b> | Buch    | bu:x          |
| <b>h</b> | Hand    | hant          |
| <b>m</b> | mein    | main          |
| <b>n</b> | nein    | naIn          |
| <b>N</b> | Ding    | dIN           |
| <b>l</b> | Leim    | laIm          |
| <b>R</b> | Reim    | RaIm          |

Table 5-10 Vowels: German

| Symbol    | Word      | Transcription |
|-----------|-----------|---------------|
| <b>I</b>  | Sitz      | zIts          |
| <b>E</b>  | Gesetz    | g@zEts        |
| <b>a</b>  | Satz      | zats          |
| <b>O</b>  | Trotz     | tR0ts         |
| <b>U</b>  | Schutz    | SUts          |
| <b>Y</b>  | hübsch    | hYpS          |
| <b>9</b>  | plötzlich | pl9tslIx      |
| <b>i:</b> | Lied      | li:t          |
| <b>e:</b> | Beet      | be:t          |
| <b>a:</b> | Tat       | ta:t          |
| <b>o:</b> | rot       | Ro:t          |
| <b>u:</b> | Blut      | blu:t         |
| <b>y:</b> | süß       | zy:s          |
| <b>2:</b> | blöd      | bl2:t         |
| <b>aI</b> | Eis       | aIs           |
| <b>aU</b> | Haus      | haUs          |
| <b>OY</b> | Kreuz     | kROYts        |
| <b>@</b>  | bitte     | bIt@          |

## A.1.6 Italian

**Table 5-11 Consonants: Italian**

| Symbol     | Word    | Transcription |
|------------|---------|---------------|
| <b>p</b>   | pane    | pane          |
| <b>b</b>   | banco   | banko         |
| <b>t</b>   | tana    | tana          |
| <b>d</b>   | danno   | danno         |
| <b>k</b>   | cane    | kane          |
| <b>g</b>   | gamba   | gamba         |
| <b>pp</b>  | coppa   | k0ppa         |
| <b>bb</b>  | gobba   | g0bba         |
| <b>tt</b>  | zitto   | tsitto        |
| <b>dd</b>  | cadde   | kadde         |
| <b>kk</b>  | nocca   | n0kka         |
| <b>gg</b>  | fugga   | fugga         |
| <b>ts</b>  | zitto   | tsitto        |
| <b>dz</b>  | zona    | dz0na         |
| <b>tS</b>  | cena    | tSena         |
| <b>dZ</b>  | gita    | dZita         |
| <b>tts</b> | bozza   | b0ttsa        |
| <b>ddz</b> | mezzo   | mEddzo        |
| <b>tts</b> | braccio | brattSo       |
| <b>ddZ</b> | oggi    | OddZi         |
| <b>f</b>   | fame    | fame          |
| <b>v</b>   | vano    | vano          |
| <b>s</b>   | sano    | sano          |
| <b>z</b>   | sbaglio | zbaLLo        |
| <b>S</b>   | scendo  | Sendo         |
| <b>ff</b>  | beffa   | bEffa         |
| <b>vv</b>  | bevvi   | bevvi         |
| <b>ss</b>  | cassa   | kassa         |
| <b>SS</b>  | ascia   | aSSa          |
| <b>m</b>   | molla   | m0lla         |
| <b>n</b>   | nocca   | n0kka         |
| <b>J</b>   | gnocco  | J0kko         |
| <b>mm</b>  | grammo  | grammo        |
| <b>nn</b>  | panna   | panna         |
| <b>JJ</b>  | bagno   | baJJo         |
| <b>r</b>   | rete    | rete          |

| Symbol    | Word   | Transcription                  |
|-----------|--------|--------------------------------|
| <b>l</b>  | lama   | l <sup>a</sup> ma              |
| <b>rr</b> | ferro  | f <sup>e</sup> rr <sup>o</sup> |
| <b>ll</b> | colla  | k <sup>o</sup> ll <sup>a</sup> |
| <b>LL</b> | foglia | f <sup>o</sup> ll <sup>a</sup> |
| <b>j</b>  | ieri   | j <sup>e</sup> ri              |
| <b>w</b>  | uomo   | w <sup>o</sup> mo              |

Table 5-12 Vowels: Italian

| Symbol   | Word | Transcription                 |
|----------|------|-------------------------------|
| <b>i</b> | mite | m <sup>i</sup> te             |
| <b>e</b> | rete | r <sup>e</sup> te             |
| <b>E</b> | meta | m <sup>e</sup> t <sup>a</sup> |
| <b>a</b> | rata | r <sup>a</sup> t <sup>a</sup> |
| <b>o</b> | moto | m <sup>o</sup> t <sup>o</sup> |
| <b>o</b> | dove | d <sup>o</sup> v <sup>e</sup> |
| <b>u</b> | muto | m <sup>u</sup> t <sup>o</sup> |

## A.1.7 Dutch

Table 5-13 Consonants: Dutch

| Symbol   | Word   | Transcription                       |
|----------|--------|-------------------------------------|
| <b>p</b> | pak    | p <sup>a</sup> k                    |
| <b>b</b> | bak    | b <sup>a</sup> k                    |
| <b>t</b> | tak    | t <sup>a</sup> k                    |
| <b>d</b> | dak    | d <sup>a</sup> k                    |
| <b>k</b> | kak    | k <sup>a</sup> p                    |
| <b>g</b> | goal   | g <sup>o</sup> :l                   |
| <b>f</b> | fel    | f <sup>e</sup> l                    |
| <b>v</b> | vel    | v <sup>e</sup> l                    |
| <b>s</b> | sein   | s <sup>e</sup> in                   |
| <b>z</b> | zijn   | z <sup>e</sup> in                   |
| <b>x</b> | toch   | t <sup>o</sup> x                    |
| <b>G</b> | goed   | g <sup>u</sup> t                    |
| <b>h</b> | hand   | h <sup>a</sup> nt                   |
| <b>Z</b> | bagage | b <sup>a</sup> g <sup>a</sup> :z(@) |
| <b>S</b> | show   | s <sup>o</sup> :u                   |
| <b>m</b> | met    | m <sup>e</sup> t                    |

| Symbol | Word | Transcription |
|--------|------|---------------|
| n      | net  | nEt           |
| N      | bang | bAN           |
| l      | land | lAnt          |
| r      | rand | rAnt          |
| w      | wit  | wIt           |
| j      | ja   | ja:           |

Table 5-14 Vowels: Dutch

| Symbol | Word        | Transcription |
|--------|-------------|---------------|
| I      | pit         | pIt           |
| E      | pet         | pEt           |
| A      | pat         | pAt           |
| O      | pot         | pOt           |
| Y      | put         | pYt           |
| @      | gemakkelijk | G@"mAk@l@k    |
| i      | vier        | vir           |
| y      | vuur        | vyr           |
| u      | voer        | vur           |
| a:     | naam        | na:m          |
| e:     | veer        | ve:r          |
| 2:     | deur        | d2:r          |
| o:     | voor        | vo:r          |
| Ei     | fijn        | fEin          |
| 9y     | huis        | h9ys          |
| Au     | goud        | xAut          |
| E:     | crème       | krE:m         |
| 9:     | freule      | fr9:l@        |
| o:     | roze        | rO:z@         |

## A.1.8 Russian

Table 5-15 Consonants: Russian

| Symbol | Word    | Transcription |
|--------|---------|---------------|
| P      | p"l'l'  | dust          |
| p'     | p'"it'  | to drink      |
| b      | b"t't'  | to be         |
| b'     | b'"t't' | to beat       |

| Symbol | Word            | Transcription |
|--------|-----------------|---------------|
| t      | t"ost           | toast         |
| t'     | t'"en'          | shadow        |
| d      | d"1m            | smoke         |
| d'     | d'"en'          | day           |
| k      | k"ot            | cat           |
| k'     | k'"it           | whale         |
| g      | g"us'           | goose         |
| g'     | g'"ipk'ij       | flexible      |
| ts     | ts"ep'          | chain         |
| ts'    | ts'"aj          | tea           |
| t-s    | d'"et-ski       | childish      |
| t-S'   | p'ir'iv"ot-S'ik | interpreter   |
| f      | f"ars           | farce         |
| f'     | f'"iz'ika       | physics       |
| v      | v"aza           | vase          |
| v'     | v'"iza          | visa          |
| s      | s"1n            | son           |
| s'     | s'"ena          | hay           |
| z      | z"apax          | smell         |
| z'     | karz'"ina       | basket        |
| s      | S"ar            | ball          |
| S':    | S':"uka         | pike          |
| Z      | Z"1r            | fat           |
| x      | xl'"ep          | bread         |
| x'     | x'"itr1j        | cunning       |
| m      | m"aj            | May           |
| m'     | m'"ata          | mint          |
| n      | najt'"i         | find          |
| n'     | n'"it'          | thread        |
| l      | l"uts'          | ray           |
| l'     | l'ub"of'        | love          |
| r      | kr"ap           | crab          |
| r'     | r'"ezat         | cut           |
| j      | ij"ul'          | July          |

Table 5-16 Vowels: Russian

| Symbol | Word    | Transcription |
|--------|---------|---------------|
| i      | m''ir   | peace         |
| l      | m''1S   | mouse         |
| e      | Z11''e  | jelly         |
| a      | p''ara  | pair          |
| o      | g''orat | city          |
| u      | tul''up | crude         |

### A.1.9 Chinese (Pinyin)

Table 5-17 Consonants: Chinese

| Symbol | Chinese Character | Transcription (pinyin) |
|--------|-------------------|------------------------|
| b      | 玻                 | bo                     |
| P      | 坡                 | po                     |
| m      | 摸                 | mo                     |
| f      | 佛                 | fe                     |
| d      | 得                 | de                     |
| t      | 特                 | te                     |
| n      | 讷                 | ne                     |
| l      | 勒                 | le                     |
| g      | 哥                 | ge                     |
| k      | 科                 | ke                     |
| h      | 喝                 | he                     |
| j      | 基                 | ji                     |
| q      | 欺                 | qi                     |
| x      | 希                 | xi                     |
| zh     | 知                 | zhi                    |
| ch     | 吃                 | chi                    |
| sh     | 诗                 | shi                    |
| r      | 日                 | ri                     |
| z      | 资                 | zi                     |
| c      | 雌                 | ci                     |
| s      | 思                 | si                     |
| y      | 衣                 | yi                     |
| w      | 乌                 | wu                     |

Table 5-18 Vowels: Chinese

| Symbol | Chinese Character | Transcription (pinyin) |
|--------|-------------------|------------------------|
| a      | 阿                 | a                      |
| ai     | 爱                 | ai                     |
| an     | 安                 | an                     |
| ang    | 昂                 | ang                    |
| ao     | 凹                 | ao                     |
| e      | 鹅                 | e                      |
| ei     | 雷<br>诶            | lei<br>ei              |
| en     | 恩                 | en                     |
| eng    | 崩                 | beng                   |
| er     | 耳                 | er                     |
| i      | 衣                 | yi                     |
| ia     | 家                 | jia                    |
| ian    | 建                 | jian                   |
| iang   | 将                 | jiang                  |
| iao    | 角                 | jiao                   |
| ie     | 列                 | lie                    |
| in     | 林                 | lin                    |
| ing    | 灵                 | ling                   |
| iong   | 炯                 | jiong                  |
| iu     | 刘                 | liu                    |
| ng     | 嗯                 | ng                     |
| o      | 哦                 | o                      |
| ong    | 龙                 | long                   |
| ou     | 楼                 | lou                    |
| u      | 与                 | yu                     |
| ua     | 抓                 | zhua                   |
| uai    | 拽                 | zhuai                  |
| uan    | 穿                 | chuan                  |
| uang   | 床                 | chuang                 |
| ue     | 决<br>略            | jue<br>lue             |
| ui     | 吹                 | chui                   |
| un     | 春                 | chun                   |
| uo     | 做                 | zuo                    |
| v      | 吕                 | lv                     |

Table 5-19 409 Syllables

|       |      |       |       |      |       |        |       |       |        |
|-------|------|-------|-------|------|-------|--------|-------|-------|--------|
| a     | chui | fo    | jiang | lin  | niang | qun    | sou   | xiu   | zhuan  |
| ai    | chun | fou   | jiao  | ling | niao  | ran    | su    | xu    | zhuang |
| an    | chuo | fu    | jie   | liu  | nie   | rang   | suan  | xuan  | zhui   |
| ang   | ci   | ga    | jin   | lo   | nin   | rao    | sui   | xue   | zhun   |
| ao    | cong | gai   | jing  | long | ning  | re     | sun   | xun   | zhuo   |
| ba    | cou  | gan   | jiong | lou  | niu   | ren    | suo   | ya    | zi     |
| bai   | cu   | gang  | jiu   | lu   | nong  | reng   | ta    | yan   | zong   |
| ban   | cuan | gao   | ju    | luan | nu    | ri     | tai   | yang  | zou    |
| bang  | cui  | ge    | juan  | lue  | nuan  | rong   | tan   | yao   | zu     |
| bao   | cun  | gei   | jue   | lun  | nue   | rou    | tang  | ye    | zuan   |
| bei   | cuo  | gen   | jun   | luo  | nuo   | ru     | tao   | yi    | zui    |
| ben   | da   | geng  | ka    | lv   | nv    | ruan   | te    | yin   | zun    |
| beng  | dai  | gong  | kai   | ma   | o     | rui    | tei   | ying  | zuo    |
| bi    | dan  | gou   | kan   | mai  | ou    | run    | teng  | yo    |        |
| bian  | dang | gu    | kang  | man  | pa    | ruo    | ti    | yong  |        |
| biao  | dao  | gua   | kao   | mang | pai   | sa     | tian  | you   |        |
| bie   | de   | guai  | ke    | mao  | pan   | sai    | tiao  | yu    |        |
| bin   | dei  | guan  | kei   | me   | pang  | san    | tie   | yuan  |        |
| bing  | den  | guang | ken   | mei  | pao   | sang   | ting  | yue   |        |
| bo    | deng | gui   | keng  | men  | pei   | sao    | tong  | yun   |        |
| bu    | di   | gun   | kong  | meng | pen   | se     | tou   | za    |        |
| ca    | dia  | guo   | kou   | mi   | peng  | sen    | tu    | zai   |        |
| cai   | dian | ha    | ku    | mian | pi    | seng   | tuan  | zan   |        |
| can   | diao | hai   | kua   | miao | pian  | sha    | tui   | zang  |        |
| cang  | die  | han   | kuai  | mie  | piao  | shai   | tun   | zao   |        |
| cao   | ding | hang  | kuan  | min  | pie   | shan   | tuo   | ze    |        |
| ce    | diu  | hao   | kuang | ming | pin   | shang  | wa    | zei   |        |
| cen   | dong | he    | kui   | miu  | ping  | shao   | wai   | zen   |        |
| ceng  | dou  | hei   | kun   | mo   | po    | she    | wan   | zeng  |        |
| cha   | du   | hen   | kuo   | mou  | pou   | shei   | wang  | zha   |        |
| chai  | duan | heng  | la    | mu   | pu    | shen   | wei   | zhai  |        |
| chan  | dui  | hong  | lai   | muo  | qi    | sheng  | wen   | zhan  |        |
| chang | dun  | hou   | lan   | na   | qia   | shi    | weng  | zhang |        |
| chao  | duo  | hu    | lang  | nai  | qian  | shou   | wo    | zhao  |        |
| che   | e    | hua   | lao   | nan  | qiang | shu    | wu    | zhe   |        |
| chen  | ei   | huai  | le    | nang | qiao  | shua   | xi    | zhei  |        |
| cheng | en   | huan  | lei   | nao  | qie   | shuai  | xia   | zhen  |        |
| chi   | er   | huang | leng  | ne   | qin   | shuan  | xian  | zheng |        |
| chong | fa   | hui   | li    | nei  | qing  | shuang | xiang | zhi   |        |



|        |      |      |       |      |       |      |       |       |
|--------|------|------|-------|------|-------|------|-------|-------|
| chou   | fan  | hun  | lia   | nen  | qiong | shui | xiao  | zhong |
| chu    | fang | huo  | lian  | neng | qiu   | shun | xie   | zhou  |
| chuai  | fei  | ji   | liang | ng   | qu    | shuo | xin   | zhu   |
| chuan  | fen  | jia  | liao  | ni   | quan  | si   | xing  | zhua  |
| chuang | feng | jian | lie   | nian | que   | song | xiong | zhuai |

## A.2 Supported Characters in the Various Languages

This library supports word registration using the following characters.

### A.2.10 English

|          |                                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alphabet | A                                | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
|          | U                                | V | W | X | Y | Z |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|          | a                                | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | a | t |
|          | u                                | v | w | x | y | z |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Symbols  | " " (0x20), "' (0x27), "- (0x2D) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### A.2.11 French

|          |                                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alphabet | A                                | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
|          | U                                | V | W | X | Y | Z | É | À | È | Ù | Â | Ê | Ô | Ë | Ï | Ü | Ç |   |   |   |
|          | a                                | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | a | t |
|          | u                                | v | w | x | y | z | é | à | è | ù | â | ê | ô | ë | ï | ü | ç |   |   |   |
| Symbols  | " " (0x20), "' (0x27), "- (0x2D) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### A.2.12 Spanish

|          |                                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alphabet | A                                | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
|          | U                                | V | W | X | Y | Z | Ñ | Á | É | Í | Ó | Ú | Ü |   |   |   |   |   |   |   |
|          | a                                | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | a | t |
|          | u                                | v | w | x | y | z | ñ | á | é | í | ó | ú | ü |   |   |   |   |   |   |   |
| Symbols  | " " (0x20), "' (0x27), "- (0x2D) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### A.2.13 German

|          |                                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alphabet | A                                | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
|          | U                                | V | W | X | Y | Z | Ä | Ö | Ü |   |   |   |   |   |   |   |   |   |   |   |
|          | a                                | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | a | t |
|          | u                                | v | w | x | y | z | ä | ö | ü | ß |   |   |   |   |   |   |   |   |   |   |
| Symbols  | " " (0x20), "' (0x27), "- (0x2D) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### A.2.14 Italian

|          |                                     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|-------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alphabet | A                                   | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
|          | U                                   | V | W | X | Y | Z | È | À | Ì | Ò | Ù |   |   |   |   |   |   |   |   |   |
|          | a                                   | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | a | t |
|          | u                                   | v | w | x | y | z | é | à | ì | ò | ù |   |   |   |   |   |   |   |   |   |
| Symbols  | " " (0x20), "'" (0x27), "- " (0x2D) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### A.2.15 Dutch

|          |                                     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|-------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alphabet | A                                   | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
|          | U                                   | V | W | X | Y | Z | Ä | Ë | İ | Ö | Ü | É | Ó |   |   |   |   |   |   |   |
|          | a                                   | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | a | t |
|          | u                                   | v | w | x | y | z | ä | ë | ï | ö | ü | é | ó |   |   |   |   |   |   |   |
| Symbols  | " " (0x20), "'" (0x27), "- " (0x2D) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### A.2.16 Russian

|          |                         |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|-------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alphabet | А                       | Б | В | Г | Д | Е | Ё | Ж | З | И | Й | К | Л | М | Н | О | П | Р | С | Т |
|          | У                       | Ф | Х | Ц | Ч | Ш | Щ | Ъ | Ы | Ь | Э | Ю | Я |   |   |   |   |   |   |   |
|          | а                       | б | в | г | д | е | ё | ж | з | и | й | к | л | м | н | о | п | р | с | т |
|          | у                       | ф | х | ц | ч | ш | щ | ъ | ы | ь | э | ю | я |   |   |   |   |   |   |   |
| Symbols  | " " (0x20), "- " (0x2D) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### A.2.17 Canadian French

|          |                                     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|-------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alphabet | A                                   | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
|          | U                                   | V | W | X | Y | Z | É | À | Ê | Ä | Ë | Î | Ô | Ë | Ï | Ç |   |   |   |   |
|          | a                                   | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | a | t |
|          | u                                   | v | w | x | y | z | é | à | è | â | ê | î | ô | ë | ï | ç |   |   |   |   |
| Symbols  | " " (0x20), "'" (0x27), "- " (0x2D) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### A.2.18 American Spanish

|          |                         |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|-------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alphabet | A                       | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
|          | U                       | V | W | X | Y | Z | Ñ | Á | É | Í | Ó | Ú | Ü |   |   |   |   |   |   |   |
|          | a                       | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | a | t |
|          | u                       | v | w | x | y | z | ñ | á | é | í | ó | ú | ü |   |   |   |   |   |   |   |
| Symbols  | " " (0x20), "- " (0x2D) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

## Revision History

| Version | Revision Date | Description                                               |
|---------|---------------|-----------------------------------------------------------|
| 1.0.2   | 2011/07/01    | Fixed bad cross-reference fields (Japanese version only). |
| 1.0.1   | 2010/10/12    | Revised the expressions used for recognition scores.      |
| 1.0.0   | 2010/06/01    | Initial version.                                          |

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